

which is processed to estimate sea surface wind speed and direction. For rain rates that exceed 1 mm h^{-1} , this can result in appreciable errors in the sea surface wind vectors derived from the affected scatterometer data. Unfortunately, the erroneous data is commonly found in the vicinity of synoptic scale, dynamic atmospheric systems, such as cyclones and frontal boundaries, where measurements of surface winds are most important for scientific investigations.

This project intends to correct the NRCS measured by the scatterometer by using electromagnetic modeling of the backscattering and attenuation by the atmosphere, for both vertical and horizontal polarizations. The method that has the best potential

for global application relies on the passive radiometric Advanced Microwave Scanning Radiometer (AMSR) measurements being made by the same satellites collecting the scatterometer data. The 3-D AMSR (precipitation water content, gm m^3) data are combined with models of the electromagnetic processes from rain propagation and scattering to remove the effects of volumetric backscatter and attenuation. The surface wind vectors are then recalculated using the corrected scatterometer NRCS.

The same general process is also performed on 3-D precipitation-reflectivity (Z) data from NEXRAD for high-resolution atmospheric rain measurements. With its conical scans, NEXRAD creates a three-dimensional view

of the rain column with 2-km resolution within 5 minutes of the satellite overpass. The results are being used to evaluate the correction method developed for the AMSR dataset, which cannot achieve the same high resolution.

Tropical cyclones provide excellent case studies to examine the impact of precipitation on scatterometer data. High-resolution NEXRAD can probe the rain at all altitudes of a

hurricane near the coast, while AMSR data provides similar information near the coast and in the open ocean. Using these data, the Ku-band attenuation and volume backscatter (for both polarizations) can be removed from the scatterometers' measured NRCS, converting the corrected sea surface NRCS into corrected winds.

An examination of Hurricane Isabel, which crossed the North Carolina coast on 18 September 2003, is being conducted. A fortuitous observation by the scatterometer occurred at about 1600 UTC. The storm was centered in the swath of the sensors, providing a rich source of both the AMSR and scatterometer data. The eye of the storm also embraced the coastline. A sample of the NEXRAD three-dimensional data for this event is shown in the figure (previous page).—DAVID E. WEISSMAN (HOFSTRA UNIVERSITY), GREGORY APGAR, JEFFREY S. TONGUE, AND MARK A. BOURASSA. "Corrections to Scatterometer Wind Vectors by Removing the Effects of Rain." 13th Conference on Satellite Meteorology and Oceanography, 20–23 September 2004, Norfolk, Virginia.

The following were presented at the 85th Annual Meeting, San Diego, California, 9–13 January 2005.

GLOBAL DIMMING AND BRIGHTENING AND THE WATER CYCLE

Is it possible to spin down of the water cycle in a warmer and moister world? The answer is yes, if the world becomes dark enough. This hypothesis contradicts the general assumption of an intensified water cycle with global warming. Observations seem to support it: while land-surface temperatures rose by about 0.3K between 1960

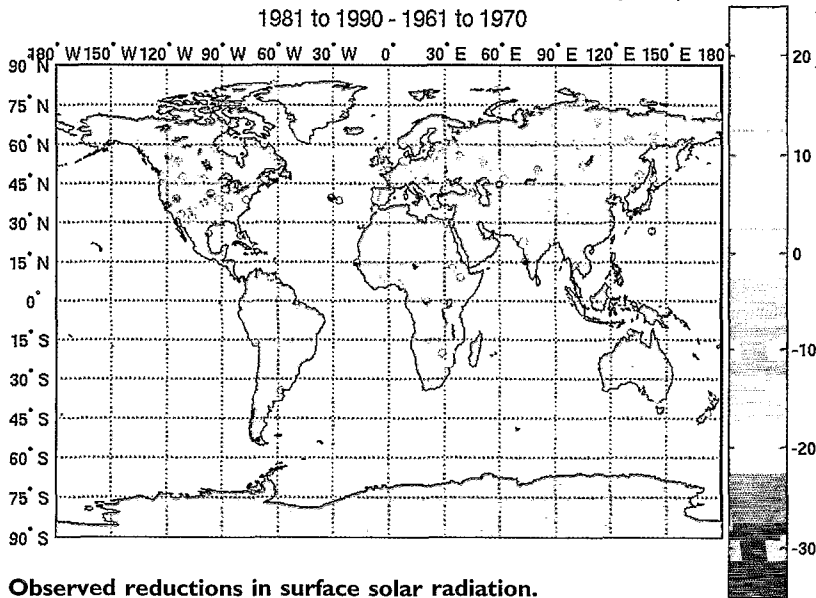
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GEBA decadal differences in surface solar radiation (W/m^2)
1981 to 1990 - 1961 to 1970



Observed reductions in surface solar radiation.

and 1991, surface solar radiation declined by about 4% on average at continental sites during the same period (see figure above). At the same time, open-water evaporation became suppressed and soil moisture increased, although atmospheric moisture derived from rawinsonde data also increased.

It has been argued that greenhouse gas-forced global warming leads to an increase in atmospheric moisture due to the increased water-holding capacity of the warmer atmosphere (Clausius-Clapeyron). Anthropogenic aerosol concentrations (particulate matter), however, can decrease

evaporation as a function of surface properties (moisture deficit, wind speed, and surface energy balance). Climate simulations performed at the Max-Planck Institute for Meteorology coupled increased greenhouse gas forcing and anthropogenic aerosol concentrations. In the model, aerosol layers near the surface reflect and absorb sunlight and are able to change cloud properties due to their role as cloud condensation nuclei. Polluted clouds tend to reflect more sunlight and are assumed to rain less effectively. Additionally, greenhouse gas-forced cloud and water vapor feedbacks tend to reduce surface solar radiation as well. The overall result is a negative surface radiative energy balance in spite of the additional longwave flux from the warmer atmosphere. This global imbalance is compensated in the model by reduced sensible and latent heat release into the atmosphere. Furthermore, the atmospheric moisture content increases because the residence time of water vapor increases (Clausius-Clapeyron). Thus, evaporation and consequently precipitation can be suppressed in a warmer, moister world if it gets dark enough.

Although "dimming" has been observed until 1990, more recent observations show a recovery ("brightening") in the last decade in some regions of the globe due to curbed air pollution and reductions in cloud coverage. Hence it can be speculated that the "brighter" future might become wetter when the water cycle spins up again due to the still-increasing greenhouse warming.—BEATE G. LIEPERT (COLUMBIA UNIVERSITY) AND A. ROMANOU. "Solar Dimming/Brightening and Consequences for the Water Cycle."

A GREENHOUSE FOR MARTIANS

Some scientists are suggesting that Mars could benefit from the same greenhouse gases that are so damaging to Earth's atmosphere. A recent article in the *Journal of Geophysical Research-Planets* proposes that injecting synthetic "super" greenhouse gases into the Martian atmosphere could raise the planet's temperature enough so that it could eventually sustain biological life. Authors of the article believe that introducing approximately 300 parts per million of a mixture of the compound octafluoropropane and similar gases would likely lead to a major greenhouse effect (fluorine-based gases are known to be absorbent of thermal infrared energy), while having minimal detrimental effects on living organisms and retaining an exceptionally long lifespan in the environment. The conditions would eventually evaporate the frozen carbon dioxide on the planet's surface, leading to a continued temperature increase and a thickening of the planet's atmosphere. The scientists believe living organisms might then have an opportunity to survive, or even flourish, on the Red Planet.